United States Department of the Interior, J. A. Krug, Secretary
Fish and Wildlife Service, Albert M. Day, Director

Fishery Leaflet 128

LIBRARY
FISH & WILDLIFE SERVICE
PACIFIC OCEANIC FISHERY
INVESTIGATIONS

Chicago 54, Ill.

Re-issued October 1946

REFRIGERATED LOCKER STORAGE OF FISH FOR HOME USE

By Martin Heerdt, Jr., Chemist; Dorris L. Bucher, and
Maurice E. Stansby, Technologists
Fishery Technological Laboratory, Fish and Wildlife Service
Seattle, Washington

Contents

	Page		Page
Introduction	1	Moisture-vapor-proof material	13
Procurement of fish	2	Glass jars	13
Cold storage locker facilities	2	Application of sharp freezing and freezer storage	15
Methods of preparing fish for freezing	3	Locker storage life	16
Whole fish	3	Shellfish	16
Packaged fish	3	Frozen precooked fish	18
Protection of fish during locker storage	10	Fish a la king	18
Ice glaze	13	Fish chowder	18
		Literature cited	19

INTRODUCTION

Food shortages resulting from the war have caused homemakers to seek alternative food sources and varied methods of preservation. For some time, surplus vegetables from the garden and fresh fruits which have been plentiful in season have been frozen and stored. More recently, the frozen-food locker, in a locker plant or in the home, has proved an excellent facility for maintaining an ever-ready supply of a wide variety of superior quality fish at moderate cost. If purchased in season, fish of the best quality can be obtained in comparatively large quantities at low prices in most localities. Properly prepared and stored, frozen fish resemble fresh fish more closely than do fishery products preserved by any other method.

Note. -- This leaflet supersedes Memorandum F.I. 2436-D, issued by the former Bureau of Fisheries.

PROCUREMENT OF FISH

If the homemaker purchases her supply of fish, she should buy from a reliable retailer, wholesaler or fisherman, in order to assure herself of a uniformly high quality product. A fresh fish has bright colors, the scales adhere tightly, the eyes are clear, the gills are red, and the flesh is firm and elastic to the touch.

When a fisherman in the family is relied upon to supply fish for freezing, he should be given directions for handling the fish. They should not be allowed to flop around in the bottom of a boat to become bruised. The fish should be killed immediately after being caught, preferably by a method which will permit the blood to drain from the flesh. The viscera and gills should be removed immediately, and the dressed fish packed in ice or placed in a refrigerator as soon as possible and held there until packaged.

A high quality product will be obtained if precautions are taken to procure fresh fish, and if the fish are not held in storage beyond a reasonable period.

COLD STORAGE LOCKER FACILITIES

Locker plant facilities are now available in all of the 48 States; however, the majority of these plants are concentrated in the northwestern and midwestern States. Housewives have accepted this form of freezing preservation so wholeheartedly that the locker storage industry, according to the U. S. Department of Agriculture (1944), has grown from 1,200 plants in 1938 to over 5,200 plants in 1944. No fewer than 23 manufacturers have made post-war plans for the production of home-locker cold-storage cabinets. The amount of service offered by each plant varies, but falls roughly into two classifications.

The limited service plant supplies refrigerated spaces consisting of metal or wooden lockers about 6 to 8 cubic feet in size which hold approximately 200 to 300 pounds of frozen products. The lockers are leased to individuals, usually on an annual basis; the renter must perform all of the work preparatory to freezing, such as cutting and wrapping meats and fish, and processing and packaging vegetables and fruits.

The complete service locker plant, in addition, dresses fish, poultry, and small animals; cools, ages, cuts, and wraps meat; and may prepare and package fruits and vegetables. These services are usually available for an additional fixed price per pound or other unit of produce.

In each classification, some plants are equipped with sharp-freezer cabinets or small rooms in which fish or other produce may be frozen more rapidly than by placing the products directly in the locker. This increase in the speed of freezing is desirable, and such rapid-freezing facilities, when available, should be utilized.

The locker-plant operator often does much to stimulate interest and increase renter utility of the locker by providing information and suggestions for the preparation of foods as well as ascertaining that packaged foods are properly prepared for maximum storage life.

METHODS OF PREPARING FISH FOR FREEZING

Two principal methods are available for preparing fish for freezing. Whole fish, either partially dressed or as they come from the water, can be frozen without further treatment; or the whole fish can be cut into chunks, steaks, or fillets, and wrapped in suitable paper or packed in glass jars. Shellfish are usually best handled in airtight containers such as glass jars.

Whole Fish

Fish as purchased in the retail or wholesale markets may be round, drawn, or dressed. The freezing of very large whole fish is not recommended because generally the entire fish must be thawed and used, and, in most cases, a very large fish provides far more than enough food for one family meal. However, institutional users who serve large quantities find freezing whole fish practicable. For this use, larger fish - particularly the various species of salmon - can be handled in the round without dressing, provided they can be frozen within a short time after catching. To prevent softening it may be necessary to eviscerate medium to small fish (e.g. trout) as soon as they are caught. With still smaller species such as smelt, it may be advisable to freeze the fish in the round, dressing them later as they are used. In order to obtain a high quality product, round fish must be frozen soon after catching.

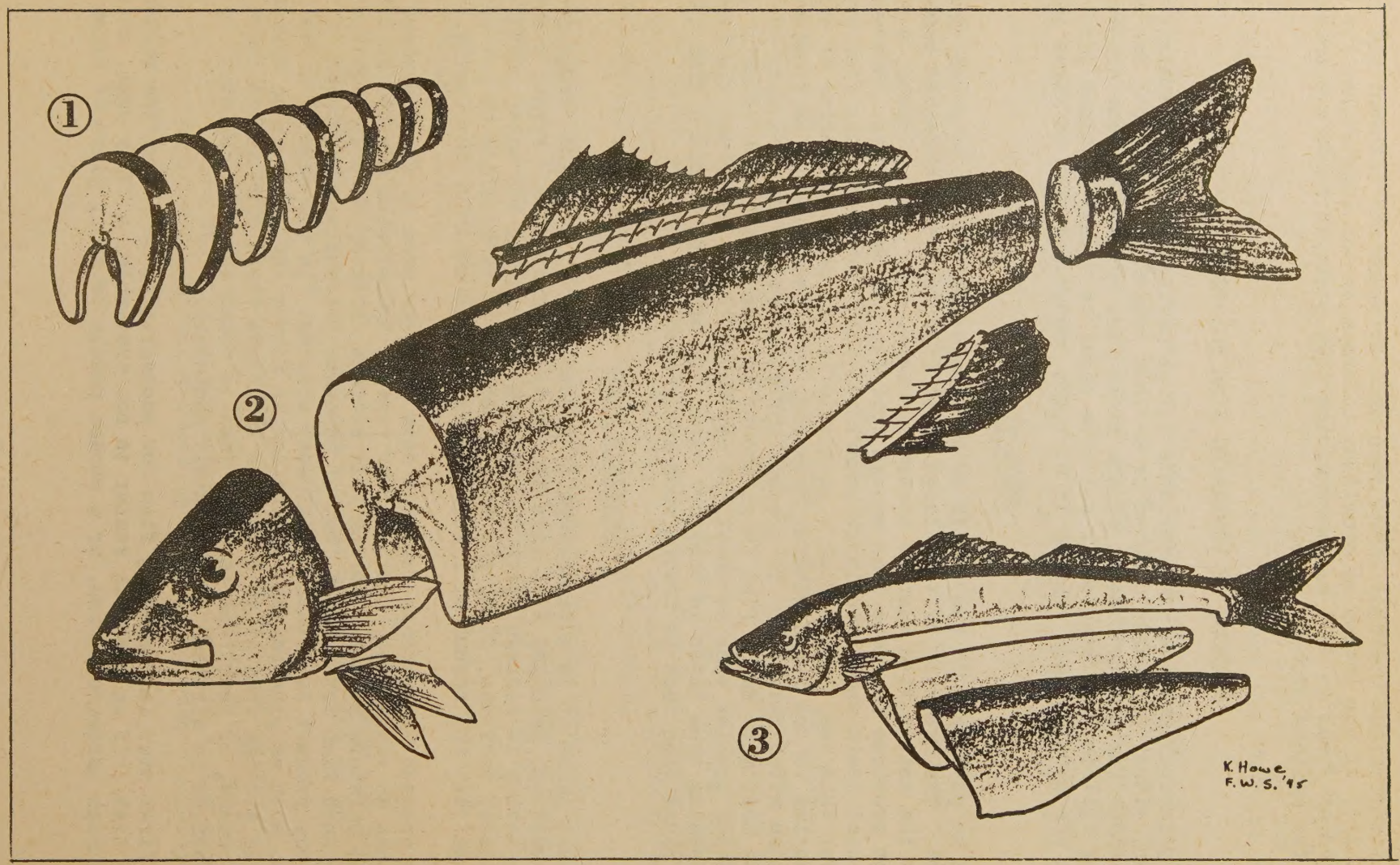
Packaged Fish

In most cases it is advantageous to freeze fish in packaged form. For home consumption, packaged fish have two distinct advantages. First, a considerable saving in storage space is realized by removing the waste portions: head, viscera, backbone, fins, and tail. Second, it is possible to put into one package just the amount of fish required for one meal for the family.

Fish dressed for package freezing have a larger area of flesh exposed to the air than do round fish. In order to prevent undesirable changes in flavor, color, and moisture content, during cold storage, greater care is required in preparing such fish for storage, but if adequate precautions are taken, a satisfactory product is obtained with most species. In the case of a few varieties, such as pink salmon, alteration in flavor and color is so marked during cold storage that it is desirable to freeze these fish in the round or in large chunks, or pack them in glass jars in order to avoid exposing any greater surface to air than is absolutely necessary.

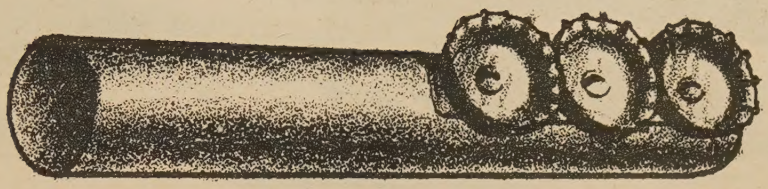
The first step in preparing fish for packaging is to remove the scales from the whole fish. If an electric scaler is not available, a curry comb, obtainable from most hardware stores, or a wooden paddle or short piece of broom handle

CUTS OF FISH

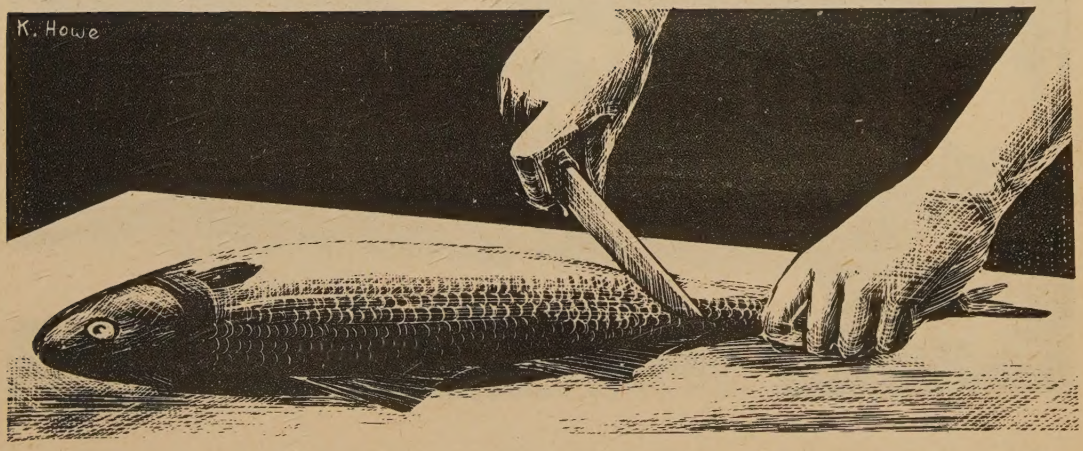


1. Steaks 2. Dressed 3. Fillets

Vegetable Paring Knife Often Used as Scaler

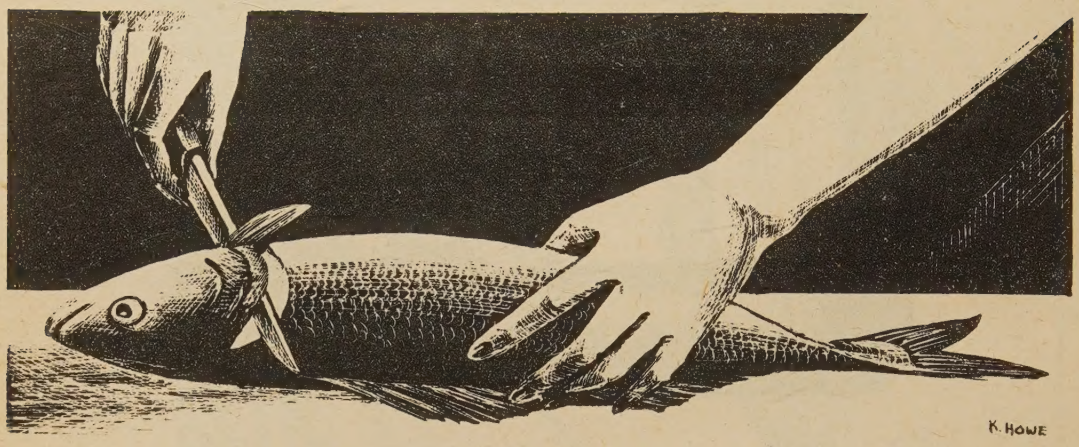


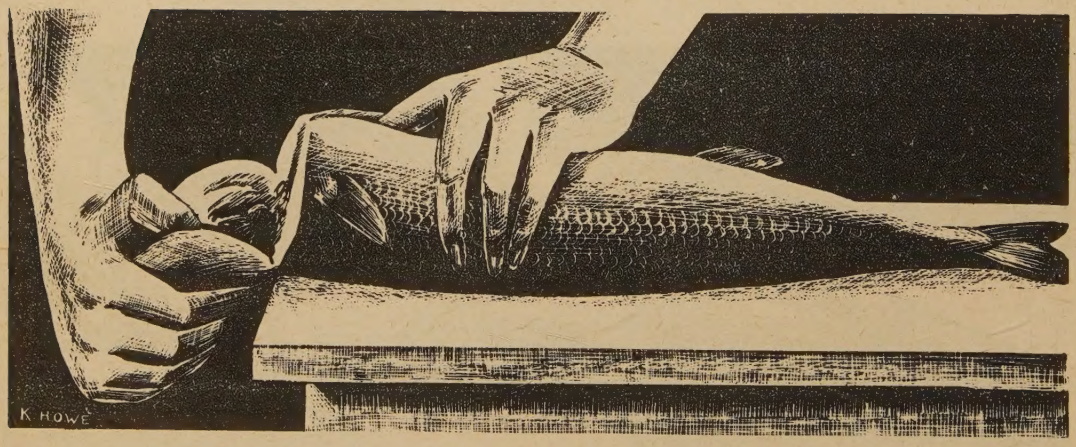
Scaler made from Short Piece of Broom Handle
with Metal Bottle Caps



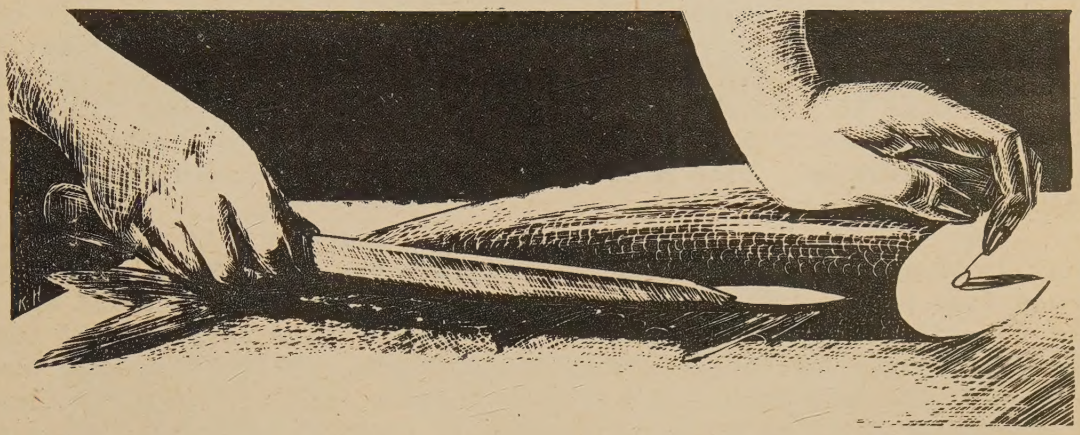
Scaling Fish with a Knife (Use Dull Blade or Back Edge of Knife)

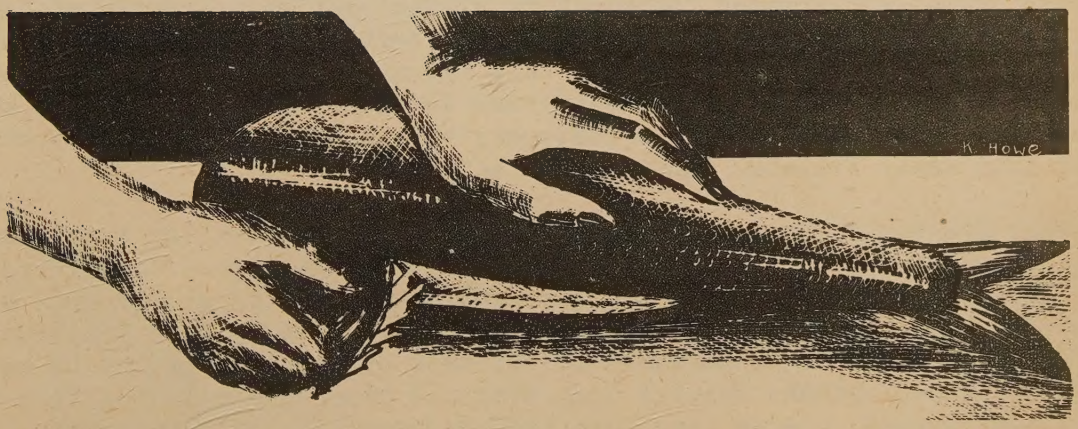
DRESSING FISH





Remove Head by Cutting Above Collarbone and Breaking Backbone at Table Edge





Remove Dorsal Fin by Cutting Along Each Side and Pulling Fin Out
(Never Trim Fins with Shears)

covered with metal bottle caps nailed closely in rows will serve the purpose. Even a dull knife will do a good job. For cutting fillets, steaks, or chunks a sharp, narrow-bladed butcher or boning knife is recommended. A cutting board, about 30 inches long by 16 inches wide, can be used to advantage in these operations.

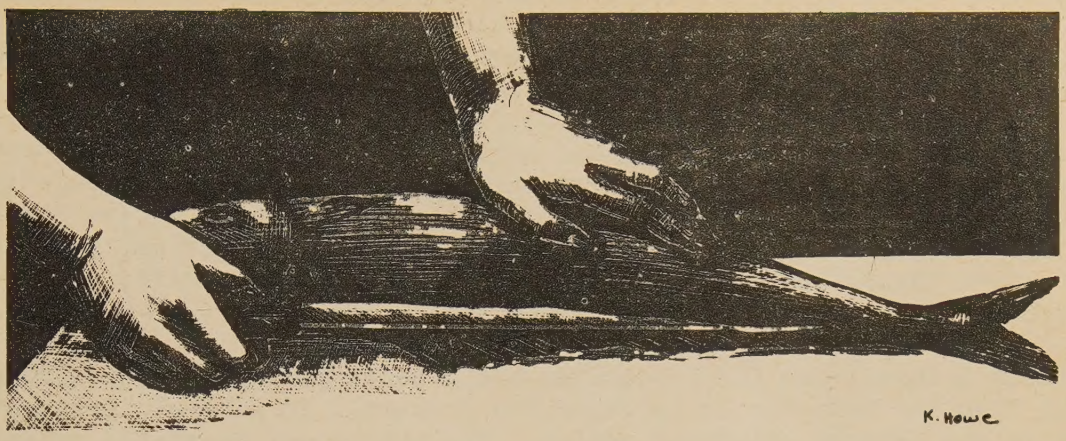
Fillets are prepared by making a cut down the back of the fish from the head to the tail. The knife passes above and is held firmly against the backbone in such a way as to leave the fins and a very narrow strip of skin adhering to the bone. The flesh is cut free from the rib bone next to the intestinal cavity. A diagonal cut is then made from a point at the top of the head downward and backwards so as to just cut off the head leaving the pectoral fin on the head side. Finally the fillet is cut free by a stroke of the knife following the side of the backbone. With most varieties, the fillet so obtained should be practically free of bones.

After cutting fillets, the skin is sometimes removed. This is done by placing the fish on the cutting board with the skin against the board and inserting the knife between the skin and the flesh at the tail end and then while holding the knife steadily with the right hand, pulling the skin toward the cutter with the left hand, and at the same time running the knife slowly forward in contact with but not cutting through the skin. With a little practice the skin can be removed in one piece without mutilating the fillet.

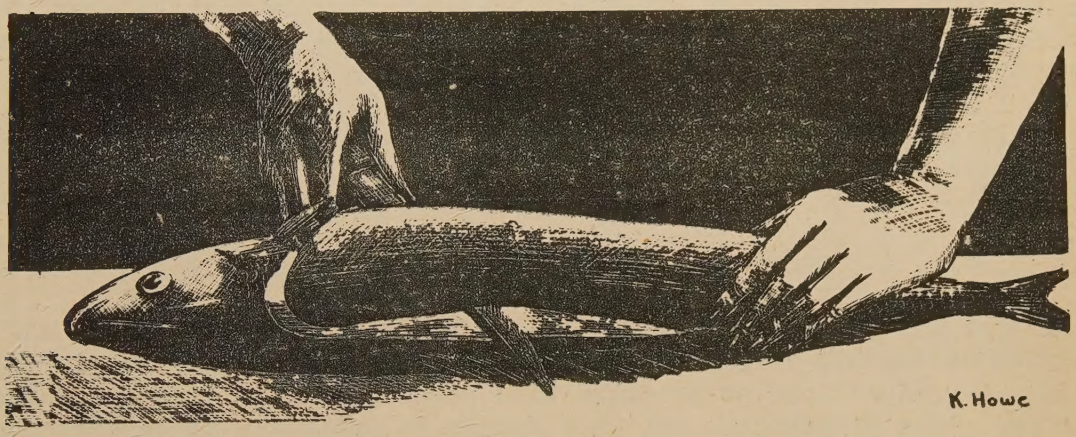
Fillets are ordinarily prepared from fish of small to medium size, one fillet weighing not more than one to one and a half pounds. It is generally better to cut steaks from larger fish. These can be cut with a sharp knife or with a band saw if available. Steaks are cut from the whole fish after removal of viscera, head, and fins. If cutting steaks with a knife, the fish is placed with the back toward the cutter, and the head to the right. Sections are cut by slicing across and through the backbone of the fish at intervals of 5/8 to one inch to produce a steak sufficient for one serving portion. The steaks are generally cut from the head toward the tail and as the narrow tail portion is reached the steaks are made somewhat thicker in order to produce pieces of approximately equal weight. It is customary to cut the narrowest section near the tail into small fillets, removing the backbone.

Chunks are cut in the same manner as steaks except that the thickness of each piece is considerably greater; e.g., four to six inches. Chunks are cut in the size deemed adequate for an entire meal, and individual servings are prepared after the fish has been thawed or cooked. Cutting fish into chunks is advantageous where it is possible to estimate closely the amount to be consumed at one time. Chunks require less wrapping paper per pound of fish than do individual steaks, and as they have less exposed flesh, discoloration and other changes are minimized. Chunks are more suitable for baking or boiling, while steaks can be fried or broiled more easily.

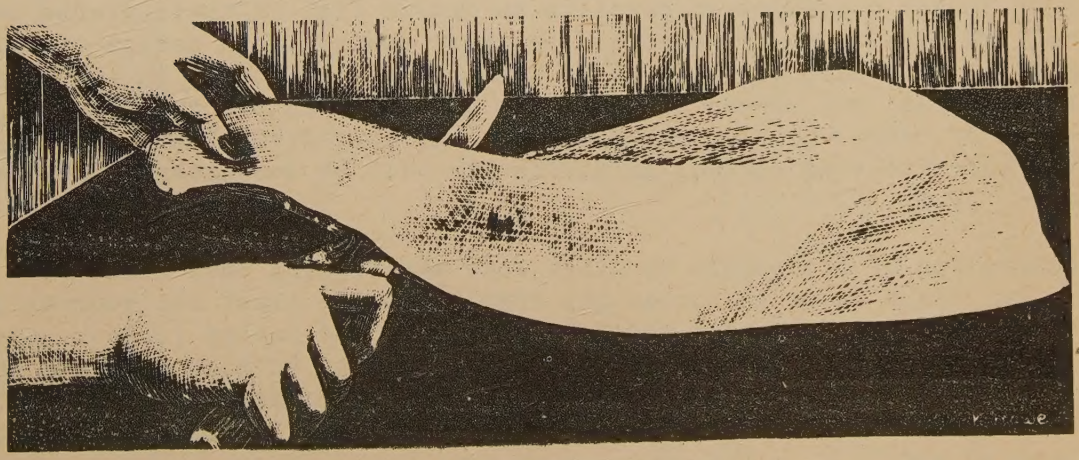
ONE METHOD OF FILLETING FISH



Cut Down the Back of the Fish From the Tail to the Head



Cut Fillet Away From the Backbone



Remove the Skin From the Fillet

In some cases it is advisable to give dressed or cut fish a preliminary brine treatment before wrapping and freezing; this pretreatment will reduce drip upon subsequent thawing. It is especially desirable for cuts of non-oily fish as cod and flounder. Commercial practice indicates the desirability of a 30-second dip in a salt solution of the following strength: two and one-half percent for croaker, flounder, sole, and mullet; and five percent for barracuda, cod, cusk, haddock, hake, halibut, pollock, rockfish, rosefish, sablefish, and whiting. Two-thirds cup of salt to a gallon of water makes a five percent salt solution, and one-third cup a $2\frac{1}{2}$ percent solution. The salt employed should be free from impurities which would adversely affect the quality of the fish. Ordinary table salt or other pure grades may be used.

Table 1 summarizes the advantages and disadvantages of various forms in storing fish for home use in refrigerated lockers. In general, preparation as chunks is the optimum all-round method. The entire cut is edible except for the backbone. Thus, refrigerating space is conserved. Fish chunks are not only suitable for baking or boiling without further preparation, but before or after thawing can be cut into steaks, or boneless pieces, for cooking in other ways. Small fish, however, cannot be prepared in this way, and should ordinarily be pan dressed. Each of the other methods described is advantageous in certain instances, but if a single all-round method is to be employed, size permitting, cutting the dressed fish into chunks will give the best results.

Tables 2 and 3 give information on recommended cuts of fresh- and salt-water fish, respectively.

PROTECTION OF FISH DURING LOCKER STORAGE

If fish are placed directly in the refrigerated locker without suitable protective treatment, several undesirable changes will take place during cold storage. A gradual loss of moisture will occur until the fish are shrunken and dried. This dehydration not only causes an unsightly appearance and alteration in texture, but also results in loss in weight and flavor. In fish not protected from the air of the cold storage room, oxidation takes place, causing discoloration and eventually total spoilage due to rancidity.

Some locker operators do not like to handle fish in their plants because they believe fish odors are absorbed by other foods. In a series of experiments conducted at this laboratory packaged fresh fish were stored in the same locker with butter which was scored periodically by expert butter graders, and no absorption of odors whatever was observed. If only fresh fish are frozen and they are adequately protected, no difficulty will be encountered from odor transfer.

Absorption of fish odors by other food may signify that stale fish were frozen, but fishy odors in butter may result from at least two sources other than fish according to Davies and Mattick (1928) and Davies (1936). One is a fishy flavor caused by feeding sugar-beet byproducts to milk cows and subsequently preparing butter from their milk; the other results from the breakdown of lecithin in dairy products, particularly in milk that has been contaminated by metal.

TABLE 1.--Comparison of various methods of preparing fish for storage in refrigerated lockers

Method	Type of Fish	Advantages	Disadvantages
Whole fish in the round	Large or very small fish. Fish with short storage life.	Keeping quality good.	Much waste material stored in locker; entire fish must be thawed and consumed at one time.
Eviscerated or pan dressed	Small to medium sized fish with short storage life.	Keeping quality good. Less waste stored in locker than when whole fish is used.	Some waste material stored in locker; entire fish must be thawed and consumed at one time.
Chunks	Medium to large sized fish.	Fish keeps well. Very little waste is stored in locker.	Not adapted to very small fish.
Steaks	Medium to large sized fish.	Very little waste is stored in locker. Flexible in that any amount can be withdrawn at one time.	Steaks are not well adapted to baking.
Fillets	Small to medium sized fish.	No waste is stored, all bone removed.	Requires special skill in preparing.

- - - - - - - - - - -

TABLE 2.--Recommended methods of preparing fresh water market fishes for storage in refrigerated lockers

Species	Producing Region	Season	Recommended Method
Blue pike	Great Lakes	May & June - November & December	Fillets
Buffalofish	Mississippi River	February to November	Chunks
Carp	Mississippi River, Great Lakes, all coastal streams	All year	do
Lake herring	Great Lakes	November & December	Round or pan-dressed
Lake trout	do	All year, principally April, May & November	Chunks
Pickerel (jack)	do	March & April	do
Sauger	do	September & October	Fillets
Sheepshead	Mississippi River & Great Lakes	April, May and June	Chunks
Smelt	Great Lakes	January, February and March	Round or pan-dressed
Suckers	Mississippi River & Great Lakes	April to October	Fillets
Whitefish	Great Lakes	June, July and August	Chunks
Yellow perch	do	April & September	Round or pan-dressed
Yellow pike	do	April & May, September & October	Chunks

TABLE 3.--Recommended methods of preparing and packaging certain salt water market fishes for storage in refrigerated lockers

Species	Producing Region	Season	Recommended Cut	Percentage of Salt in Brine Dip 1/	Cold storage life in months, based on method of packing	
					Wrapped in moisture-vapor-proof material	With 2½ percent brine in glass jars
Cod	New England, Mid-Atlantic and Pacific	All year	Fillets	5	9	-
Cusk	New England	do	do	do	9	-
Flounders and sole	Atlantic and Pacific	do	do	2½	6	-
Haddock	New England and Mid-Atlantic	do	do	5	9	-
Hake	do	do	do	do	9	-
Halibut	North Pacific and North Atlantic	April-September	Steaks	do	9	-
Herring, sea	Atlantic and Pacific	All year	Round or dressed	None	-	6
Mackerel	New England, Mid-Atlantic and Pacific	June-February	Fillets	do	-	6
Mullet	Gulf and South Atlantic	All year	do	2½	6	-
Pollock	New England and Mid-Atlantic	do	do	5	9	-
Rockfishes	Pacific	do	do	5	9	-
Rosefish	New England	do	do	5	9	-
Sablefish	Pacific	June-November	Chunks or steaks	5	9	-
Salmon:						
Chum(Fall)	North Pacific	October-November	do	None	6	9
King(Chinook)	Pacific	April-September	do	do	6	9
Pink	North Pacific	July-September	Chunks	do	2/	6
Silver	Pacific	June-October	Chunks or steaks	do	6	9
Sockeye	do	July and August	do	do	6	9
Smelt	Atlantic and Pacific	All year	Round	None	-	6
Snapper, red	Gulf and South Atlantic	do	Chunks	do	6	-
Whiting	New England and Mid-Atlantic	May-October	do	5	9	-

1/ Immerse 30 seconds in brine of the weight-percent given.
2/3 cup of table salt to one gal. of water gives a 5 percent solution.
1/3 " " " " " " " " " " " " 2½ " " "

2/ Freeze in round or in large chunks, ice glazed and wrapped, or pack in glass jars only. Wrapping only in different type papers has been found unsatisfactory.

Ice Glaze

In commercial practice, frozen whole fish, and sometimes dressed fish, are dipped in cold water to form a protective layer of ice on the outside of the fish. This ice layer effectively seals the fish, preventing access of oxygen from the air, and any evaporation which takes place comes from the ice glaze and not from the fish itself. Fish which are glazed in this way are commonly dipped in or sprayed with water at intervals during the storage period to replace ice lost through evaporation. It would be more convenient for locker patrons to wrap the glazed fish in some suitable moisture-vapor-proof material, and thus prevent loss of glaze or necessity for its replacement. A moisture-vapor-proof parchment paper is satisfactory for this purpose.

The glazing of frozen fish, as practiced commercially, requires special equipment and experience and is not recommended to locker users unless they are able to obtain advice and help from locker plant personnel. Glazing has the further disadvantage of requiring several trips to the locker plant to complete the operation. However, if it is desired to employ an ice glaze, the following procedure may be used. Freeze the fish; then place a pan of water in the locker, until the temperature reaches 33-40° F.; dip the fish in the cold water; remove and let the water-film freeze. The dipping operation should be repeated until a heavy glaze is formed. Reglaze at intervals or, preferably, protect original glaze by wrapping the fish in moisture-vapor-proof material.

Moisture-Vapor-Proof Wrappings

The method of applying the wrapper and the selection of appropriate material are very important to the successful storage of the frozen fish. The available wrappings include transparent cellophane, vegetable parchment, and similar materials. Ordinary wax paper (paraffin coated) is not entirely suitable, because it is not completely moisture-vapor-proof and in use the wax coating cracks at the folds permitting even more moisture to escape. The material chosen should be specially treated to retard the passage of water vapor or air. For chunks or other large pieces, a tough wrapping, such as vegetable parchment, should be used. The material does not need to be as strong for wrapping fillets or small steaks.

Chunks are sometimes glazed before wrapping. This process is carried out just as with whole fish, and the chunks are then wrapped in moisture-vapor-proof wrappers. Chunks prepared in this way have maximum storage life. In packaging fish it is most important to wrap the product tightly so as to leave the least possible air space within the package. A very small volume of air is sufficient to cause considerable oxidation which results in discoloration and rancidity. It is advisable to use a generous amount of wrapping material to provide overlaps at the ends. These can be folded over and fastened with cellulose-fiber tape or rubber bands, or tied with string.

Glass Jars

Glass fruit jars fitted with airtight covers meet all of the moisture-vapor-proof requirements of a container for frozen foods. They are generally available in the home as containers for canned foods and provide equal utility in the

protection of frozen fish. Steaks, fillets, very small whole or round fish, and shellfish should be carefully packed in the jar to within one and one-half inches of the top for quart jars and one inch of the top for pint jars. Enough 2½ percent brine should be added to fill the spaces between and around the fish and to just cover the product. Entrapped air bubbles should be removed with the aid of a spatula or blunt knife. The lid should be screwed tightly into place on the rubber gasket, assuring an airtight seal. The jars are now ready for freezing and subsequent storage. The ice serves to keep the air in the jar away from the fish, and the jar seal prevents loss of moisture from the contents.

TABLE 4.--Comparison of protective qualities of various materials

Protection	Method of preparation	Advantages	Disadvantages
1. Ice glaze	Round, dressed or drawn fish. Chunks.	Only satisfactory method for fish in the round.	Reglazing is required at intervals.
2. Moisture-vapor proof paper 1/	Chunks, steaks, fillets and very small fish.	Ease of handling.	Not adequate for fish which have a short storage life.
3. Glass jars	Steaks, fillets and very small fish.	Maximum protection.	Difficult to pack into small neck of jars. Color may leach.

Table 4 summarizes the protective qualities of materials used in packaging locker-storage fish. No one material is suitable for all cuts of fish; however, glazed chunks wrapped in moisture-vapor-proof paper are protected nearly as well as the cuts packed in jars. In general, glazing is a good form of protection, wrapping in moisture-vapor-proof paper a better one, and packing in glass jars in 2½ percent brine gives maximum protection.

All packages and jars of fish should be plainly labeled and inventoried. Glass and cellophane surfaces, provided they are clean and dry, can be readily marked by the use of a wax pencil (glass-marking pencil). Only when the wrapping material has so glossy a surface that it cannot readily be written upon is it advisable to use separate labels. These are best cut from thin cardboard. Writing should be large and legible, and the use of a red pencil may help in reading since refrigerated locker rooms are usually only dimly lighted. The cardboard label can, if necessary, be attached to the package by means of cellulose fiber tape. The label should indicate the species of fish, the way in which it is dressed, the number of pieces, and the date of freezing. For example: Silver salmon, 4 steaks, frozen Nov. 15, 1944. This information should also be entered on the locker inventory card, as follows:

1/ Moisture-vapor-proof paper may be used to wrap glazed chunks for protection against evaporation of the glaze.

Frozen	Packages	Product and Cut	Pieces	Use Before
Date	No.		No.	Date
Nov. 15, 1944	1	Silver Salmon Steaks	4	May 15, 1945

APPLICATION OF SHARP FREEZING AND FREEZER STORAGE

If the locker plant in which frozen fish is to be stored is equipped with a sharp freezer, fish should be frozen in it and then transferred to the locker. The sharp freezer consists of a room having sufficient refrigeration capacity to operate at sub-zero temperature. Usually, the pipes containing the refrigerating medium are constructed in the form of shelves upon which the trays of fish are placed, although plates containing the refrigerating medium are sometimes used. In some installations rapid circulation of air is accomplished by means of blowers. When pipes containing the refrigerating medium and a blower capable of rapidly circulating air are combined in a single compact enclosed unit, the resultant unit is called a blast freezer.

The time required for freezing the fish is reduced from about 48 hours in the case of large fish placed directly in the locker to 12 to 24 hours or sometimes less by using a sharp freezer. This reduction in the time required to freeze fish is an aid in producing a product which upon thawing resembles most closely the original unfrozen fish. Furthermore, the use of the sharp freezer prevents the undesirable warming (temperature fluctuation) of frozen produce already in the locker that takes place whenever unfrozen packages are added. However, if no sharp freezer is available the products can be placed directly in the refrigerated locker for freezing.

After freezing (over night or for the length of time recommended by the locker plant operator) in the sharp freezer the fish should be transferred to the locker and not be disturbed until required for consumption. It is most important that the locker operator hold the room temperature below 10° F., preferably below zero, and a minimum of temperature fluctuation is desirable as an even storage temperature retards drying and prolongs storage life of the frozen fish.

If fish are to be thawed before cooking they should be removed from the storage locker about 24 hours in advance. The frozen product can be thawed by leaving it on a lower shelf of an ordinary household refrigerator or other cool place for this period of time. The wrapper should be removed as soon as it can be separated from the frozen block and the fish placed in a vessel to catch any drip during defrosting. Fish in glass jars should be allowed to thaw before removal of the contents; the product must then be taken immediately from the jar and used as fresh fish. Do not attempt to store glass-packed frozen fish at room temperature, or spoilage will result.

If it is desired to cook frozen fish immediately after removal from the locker, it is important to allow a somewhat longer cooking time than for fresh or defrosted fish since additional heat is required. Thus, for baking or frying, the center of the fish will have time to cook thoroughly without burning the surface if a slightly lower than normal temperature is used and the cooking time increased.

LOCKER-STORAGE LIFE

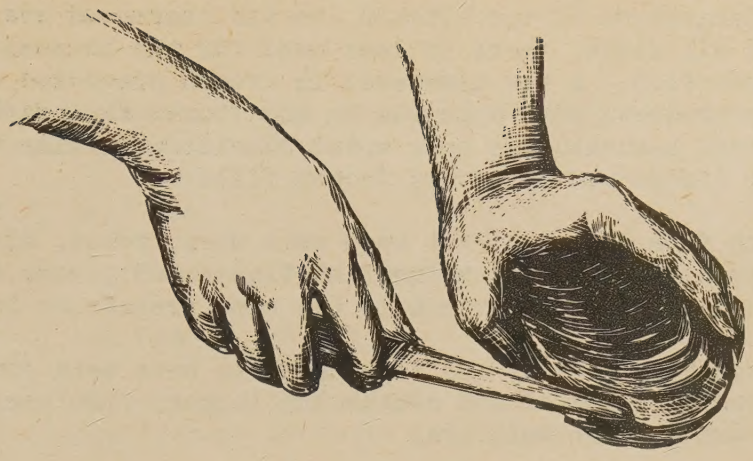
Too frequently the locker user fails to realize that fish as well as other foods have a maximum storage life even in the frozen state. The dry atmosphere of the storage room and the difficulty encountered in sealing the product away from air contribute most to shortening storage life.

Several changes take place in locker storage which must be guarded against by adequate packaging to exclude air. One change, common to all frozen fish, is a gradual removal of moisture from the flesh over a prolonged storage period in the relatively dry atmosphere of the cold-storage room. This drying renders the fish tough, fibrous, and insipid. The other change which occurs with certain oily fish is an oxidation resulting in development of rancidity, fading or other changes in the pigments of fish having colored flesh (as salmon), and development of off colors (usually yellow or brown) sometimes known as "rust." These changes eventually render the fish flesh inedible. Table 3 which contains experimental data from Stansby and Harrison (1942) and Stansby and Dassow (1942) may be used as a guide in selecting a packing method and estimating the storage life of the frozen salt-water fishes listed, as well as of other fish of a similar type. In general, a locker storage life of at least six months may be expected for most properly packaged frozen fish.

SHELLFISH

Shellfish present a problem quite different from fin fish in that more preparation is necessary before they can be frozen. Since some shellfish are available for only short periods of the year, it may be especially advantageous to freeze them for later home use.

Oysters, scallops, and clams can be successfully frozen. Since considerable practice is required in order to open the shells satisfactorily, an inexperienced person will do better to obtain the shucked products, which are readily available in season. Prior to shucking all bivalves should be washed in clean water to eliminate sand. Oysters and clams are opened by inserting a slender bladed knife between the shells so as to sever the adductor muscle from the shell. The bill of the shell may have to be hammered off to permit inserting the knife. Incidentally, when shucking scallops only the adductor muscle or "eye," as it is called, is utilized. To eliminate additional sand, the raw shellfish meats may be washed under a spray or clean cold water or in a $2\frac{1}{2}$ percent brine solution. After draining, they are packed in glass jars and covered with $2\frac{1}{2}$ percent brine before sealing, as described on page 9.



Insert Knife Between Shells to Open Oysters

The commercial pack of frozen shrimp exceeds those of all other frozen shellfish packs combined. For locker storage, raw shrimp are most successfully frozen after breaking off the heads and appendages but without removing the shell from the tail or edible portion. The tails are then washed and packed in glass jars with a 2½ percent brine. Shrimp may be cooked before freezing. If a frozen cooked product is desired, the raw shrimp should be headed, the shell and appendages peeled from the tail portion and the raw meat boiled in 15 percent brine for 4 to 15 minutes, depending on size. The cooked shrimp are then packed into jars for freezing with or without the addition of brine. Cooked shrimp may toughen somewhat when frozen, and when stored for long periods of time a salt-fish or rancid flavor develops.

Live crabs and lobsters should be cooked for 20 minutes in boiling 2½ percent salt brine. When cool the carapace or top shell, gills, and viscera of the crab are removed and the body meat taken out with a pointed knife. The meat from the claws of crabs and lobsters may be removed by cracking the claws with a small wooden mallet and shaking or picking out the meat. In addition to the claws, the tail of a lobster contains edible meat. The meat in the tail may be removed with a fork; it is then split for removal of the intestinal tract. Crab meat and lobster meat should be packed in jars with 2½ percent brine.

In most cases it is best to use frozen shellfish within a period of three or four months; however, a storage life of six months may be attained where storage accommodations are especially good, and the temperature is as low as -10° F.

FROZEN PRECOOKED FISH

With the mechanization of the kitchen and the increased availability of processed foods of all kinds, there is less need for the housewife to spend hours on meal preparation. A new timesaver is frozen precooked food. Recently, many new products have appeared in the frozen food markets. The Fishery Technological Laboratories have spent considerable time working on precooked frozen fish dishes and precooked frozen fillets.

Although plain fish flakes do not keep well when frozen, due to the large surface area exposure, many dishes using fish flakes and pieces of fish may be prepared in large quantities and stored in the home freezer or locker.

Fish a la king, fish loaves, and fish chowders have been found to keep especially well over a period of six months and longer. Two recipes that have been tested and found to keep well are:

Fish a la King

2 cups cooked fish flakes
1 cup green pepper, minced
3 tablespoons pimiento, minced
5 tablespoons butter, or other shortening
½ cup flour
4 cups milk
1 teaspoon salt
¼ teaspoon pepper

Simmer green pepper and pimiento in shortening until tender. Add flour, stir in milk gradually. Heat with constant stirring until thickened. Add fish and seasoning. Pack in pint glass jars, attach lids, and freeze. Makes 3 pints.

Thaw and stir occasionally while heating, then serve.

Fish Chowder

1 cup cooked fish flakes
½ cup water
2 cups cubed potatoes
¼ cup diced salt pork
1 cup chopped onion
2 tablespoons flour
1½ cups milk
1 teaspoon salt
1/8 teaspoon pepper

Cook cubed potatoes in salted water until tender. Fry salt pork and onions golden brown. Add flour and milk, and cook until slightly thickened. Add potatoes, fish flakes, salt and pepper. Pack into glass jars, attach lids, and freeze. Makes 2 pints.

This recipe should be thinned with an equal quantity of milk before heating and serving.

LITERATURE CITED

DAVIES, W. L.

1936. The fishy flavor of milk caused by feeding beet byproducts. Agr. Progress 13, 112-15.

------, and MATTICK, A. T. R.

1938. Cause of fishiness in dairy products. Nature 121, 324.

STANSBY, MAURICE E., and DASSOW, JOHN A.

1942. Technical Report No. 1, July 25, Fisheries Experimental Commission of Alaska Fishery Products Laboratory, Ketchikan.

------, and HARRISON, ROGER W.

1942. Special Scientific Report No. 15, U. S. Fish and Wildlife Service. (Out of print).

U. S. DEPARTMENT OF AGRICULTURE

1944. Department of Agriculture reports increase of locker plants. Ice and Refrigeration 107, No. 4, 62.

YOUNG, OTTO C.

1940. Experiments on the preparation of shrimps for freezing. Biol. Board Can. Pacific Biol. Sta. and Pacific Fisheries Exptl. Sta. Progress Rpts. 43, 3-5.

--o--

115391